ORD 5262-66
28 November 1966

MEMORANDUM FOR THE RECORD

SUBJECT: Conference on Biological Image Processing

1. I attended the Conference on Biological Image Processing on 17 and 18 November in Pacific Palisades, California along with approximately thirty-five others from government, industry, and universities (see Attachment A). The conference was mis-titled as it really was concerned with the processing of biological images and in that sense was of far less value to me than I anticipated. The papers presented were divided into three areas: preprocessing; feature extraction; and design of classification logic. In general the participants were well known leaders in the field, although I was greatly disappointed by the presentations. I suspect that the major purpose of the conference was to engender additional support from NIH. It is regrettable that some of the attendees [redacted] did not present their work. I am sure their work is of more significance generally than the papers which were presented (see Attachment B).

25X1

2. Pre-Processing. [redacted] have been using a P&E flying spot scanner to detect chromosomes in metaphase and to distinguish leucocytes of various types. The scanner has a 50 μ spot projection. Results now indicate a false-positive rate of approximately 75% and, as compared to human observers, picks up 20-30% of mitotic cells in a given field. The speed advantage is as yet undetermined and the accuracy is low. As an example, a field containing 5×10^6 chromosomes showed 1360 stops of which 377 were valid, 213 were artifacts, and 770 represented surface contamination.

25X

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3. Image Extraction.

25X1 a. [redacted] MIT is developing a reading machine for the blind which scans conventional characters with a goal of 1% error rate using a standard font. The output is either spelled speech or braille and the scanner is a flying spot with a 50 x 30 matrix. Letters are not stored in a memory, only a dictionary for the scanner. Any given letter may require two to ten code words to differentiate it from similar letters. Currently [redacted] has a 3% error rate on one font and a 10% error rate using different fonts. He would ultimately like to go from spelled to direct speech or simulated speech form but is hung up on the syntactic or phonetic problems. He is more optimistic about their resolution than I am. 25X

25X1 b. [redacted] Berkeley described a "dumb waiter" technique for repeated and automatic growth and analysis of bacteriological colonies. He has completed the engineering design and aspects to be able to handle five to ten thousand plates. His flying spot scanner (Litton) is driven by a PDP-6 and ultimately by a PDP-8. It is his objective to be able to measure, log, and file not only specific colonies but also to automatically plate out representatives from a given colony for further studies on toxicity, identification and susceptibility to antibiotics. I suspect he will be successful. It will be a wonderful machine to behold but probably not practical for other than research purposes.

25X1 c. [redacted] reported on his current experience on automating the processing of mammograms taken by X-rays using pattern recognition. His approach is essentially a four-vector analysis. Vector #1 measures the percentage of a grid square occupied by one of eight gray scales. Vector #2 looks for the uniformity of the gray scale in the grid. Vector #3 looks vertically for the presence of

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density levels. Vector #4 is a combination which looks for the "balance" or symmetry of these grids and makes appropriate comparisons. His work shows some promise and may be of value in the facial recognition problem at some future time.

d. The presentation [redacted] on the differentiation of leucocytes using a TV scan microscope was incredibly bad and does not warrant summarization. 25X

e. The evening talk was given by [redacted] 25X
25X1 [redacted] JPL on the use of high resolution filters to improve Ranger photographs. The presentation was excellent, and there was no question that there was remarkable cleaning up of the photographs. It was [redacted] view that these 25X
techniques could be useful when applied to reading X-rays and angiograms. However, their initial attempts to do this showed little improvement.

25X1 f. [redacted] began the second day with a very fine presentation on feature extraction from chromosomes and leucocytes. The system known as CYDAC will handle thirty-two levels of gray and looks primarily at the density of chromosomal material as well as their boundaries. They have a relatively low error rate in separating chromosomes which they feel may be due to temporary instability of their rastor scan system. I would suspect that we might have some ideas in the analysis laboratory which would assist in this kind of problem. Their results with leucocytes are very good, although their sample size is extremely small. [redacted] 25X
has been primarily responsible for the computer software.

3. Design of Classification Logic.

25X1 a. [redacted] was asked to discuss discriminate vs. logic models of pattern analysis. Papert, a disciple of Minsky at MIT, gave a totally irresponsible harangue which

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failed to generate any light and even relatively little heat. Even his strong British accent and apparent sense of humor were not adequate to hide his lack of knowledge about pattern recognition and artificial intelligence.

b. I missed the discussion by [redacted] 25X but met him later at dinner. He apparently has been quite active in the design of ILLIAC III and feels it has considerable potential in processing graphic data and is highly imaginative. Because of security restraints, I could not discuss it with him further but suggested he get in touch with us. He believes he has had some dealings with the Agency previously and would like to discuss it further.

4. The summaries were given by [redacted] 25X
25X1 [redacted] each trying to outdo the other with tedious and repetitious remarks about the future of biological image processing. I noted one interesting comment by [redacted] who had recently attended the 25X IEEE conference on pattern recognition. He felt that in general the biological engineering groups were well ahead of others in pattern recognition, a rather paradoxical statement from an individual who is institutionally opposed to it.

5. No specific actions are required as a result of this 25X meeting, although I feel that [redacted] or perhaps some individuals 25X in Analysis Division should take a close look at ILLIAC III if they have not already done so.

[redacted]

Deputy Director
of
Research and Development

Attachments
As Stated
Distribution:
O - Record; 1 - Circulation; 1 - DD Chrono; 1 - ORD Chrono
25X1 ORD/DD/S&T [redacted] (25 November 1966)

ATTACHMENT A

LIST OF PARTICIPANTS FOR CONFERENCE ON BIOLOGICAL IMAGE PROCESSING

25X1

University of California, Los Angeles
Central Intelligence Agency
Air Force Cambridge Research Laboratory
University of California, Los Angeles
IBM Corporation, Los Angeles
Space Technology Laboratory, Inc.
Washington University, St. Louis
National Institutes of Health
University of California, Los Angeles
National Institutes of Health
Massachusetts Institute of Technology
Massachusetts General Hospital
University of California, Los Angeles
National Institutes of Health
University of California, Berkeley
National Institutes of Health
University of Rochester
The Johns Hopkins University
Douglas Aircraft Co., Newport Beach, Calif.
National Institutes of Health
University of California, Los Angeles
Stanford University, Palo Alto
National Institutes of Health
Albert Einstein College of Medicine, Yeshiva University
University of Illinois, Urbana, Illinois
University of Pennsylvania
Massachusetts Institute of Technology
Jet Propulsion Laboratory
New England Medical Center Hospitals
Stanford Research Institute
University of California, Los Angeles

25X1

[redacted]

Massachusetts Institute of Technology
National Institutes of Health
Perkin Elmer Corporation, Norwalk, Conn.
University of Pennsylvania
Douglas Aircraft Co., Newport Beach, Cal.
Presbyterian Medical Center, San Francisco
British Medical Research Council
Argonne National Laboratory
Jet Propulsion Laboratory
University of Kansas
The Johns Hopkins University
State University of New York
National Institutes of Health
University of Pittsburgh
National Institutes of Health
University of Washington, Seattle
University of Pennsylvania

ATTACHMENT B

UCLA AND THE NATIONAL INSTITUTES OF HEALTH

CONFERENCE ON
BIOLOGICAL IMAGE PROCESSING

November 17 and 18, 1966
Santa Ynez Inn, Pacific Palisades, California
Terrace Room

FINAL AGENDA

25X1 25X1

Thursday, November 17 - [redacted] Chairman

9:00 - 9:10	Introductory Remarks
9:10 - 9:30	Survey of Image Processing Phases
	Preprocessing:
9:30 - 10:30	I. Automatic screening of metaphase spreads for chromosome analysis
10:30 - 11:00	Coffee Break
	Feature Extraction:
11:00 - 12:00	I. Application of character recognition techniques to the development of reading machines for the blind
12:00 - 1:30	Luncheon
1:30 - 2:30	II. Automated system for growth and analysis of bacterial colonies
2:30 - 3:30	III. Automatic processing of mammograms
3:30 - 4:00	Coffee Break
4:00 - 5:00	IV. Automatic differentiation of white blood cells
6:00 - 7:00	Social hour
7:00 - 8:00	Dinner
8:00 - 8:30	Digital Video Data Handling: Mars, the Moon and Men

25X1 Friday, November 18 - [redacted] Chairman 25X1

Feature Extraction (continued):

9:00 - 10:00 V. Recognition of chromosomes

10:00 - 10:30 Coffee Break

Design of Classification Logic:

10:30 - 11:30 I. Discriminant vs. logical models for pattern analysis

11:30 - 1:00 Luncheon

1:00 - 2:00 Advances in development of image processing hardware

2:00 - 2:30 Image processing in the biomedical sciences: predictions and needs

2:30 - 3:00 Coffee Break

3:00 - 4:30 Summation:

For biomedicine

For hardware

4:30 Conference adjourned

[redacted]